

Application No. 10/763,268
Amendment dated April 20, 2006
Reply to Office Action of December 20, 2005

Docket No.: 21581-00160-US3

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior listings and versions of the claims in this application.

1-11 (Canceled)

12. (Currently amended) A vinyl polymer having a crosslinkable silyl group at at least one terminus of its main chain, which is prepared by adding a hydrosilane compound having a crosslinkable silyl group to the polymer according to claim 13 a vinyl polymer having an alkenyl group of the following general formula (1) at at least one terminus of its main chain:

-CH₂-C(R¹)(R²)-O-R³-C(R⁴)=CH₂ (1)

wherein R¹ and R² are the same or different, and each represents a hydrogen atom or a univalent organic group derived from the group bound to a vinyl group of a vinyl monomer used for the production of a main chain of the polymer; R³ represents a divalent organic group having 1 to 20 carbon atoms and optionally containing one or more ether or ester bonds; R⁴ represents hydrogen, a alkyl group having 1 to 10 carbon atoms, an aryl group having 6 to 10 carbon atoms, or an aralkyl group having 7 to 10 carbon atoms.

13. (Currently Amended) A vinyl polymer having an alkenyl group of the following general formula (5) at at least one terminus of its main chain:

-CH₂-C(R¹)(R²)-C(R⁶)(R⁷)-R⁸-C(R⁹)=CH₂ (5)

wherein R¹ and R² are the same or different, and each represents a hydrogen atom or a univalent organic group derived from the group bound to a vinyl group of a vinyl monomer used for the production of a main chain of the polymer; R⁶ and R⁷ are the same or different, and each represents an electron-withdrawing group or one of them represents an electron-withdrawing group with the other representing hydrogen, an alkyl group having 1 to 10 carbon atoms, or phenyl; R⁸ represents a direct bond or a divalent organic group having 1 to 10 carbon atoms and optionally containing one or more ether bonds; R⁹ represents hydrogen, an alkyl group having 1 to 10 carbon atoms, an aryl group having 6 to 10 carbon atoms, or an aralkyl group having 7 to 10 carbon atoms).

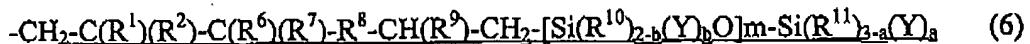
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14. (Original) The polymer according to Claim 13 wherein an electron-withdrawing group represents one group selected from the group consisting of -CO₂R (in which R represents an alkyl group having 1 to 20 carbon atoms, an aryl group having 6 to 20 carbon atoms, or an aralkyl group having 7 to 20 carbon atoms), -C(O)R (R represents the same as mentioned above), and -CN.
15. (Previously presented) The polymer according to Claim 13 wherein its main chain is prepared by polymerizing a (meth)acrylic acid type monomer.
16. (Original) The polymer according to Claim 15 wherein the (meth)acrylic acid type monomer is an acrylic ester monomer.
17. (Original) The polymer according to Claim 15 wherein the (meth)acrylic acid type monomer is a methacrylic ester monomer.
18. (Original) The polymer according to Claim 16 wherein the acrylic ester is butyl acrylate.
19. (Previously presented) The polymer according to Claim 13 wherein its main chain is prepared by polymerizing a styrene type monomer.
20. (Previously presented) The polymer according to Claim 13, wherein a ratio (Mw/Mn) of its weight average molecular weight (Mw) to number average molecular weight (Mn) as determined by gel permeation chromatography is not over 1.8.
21. (Previously presented) The polymer according to Claim 13, wherein its number average molecular weight ranges from 500 to 100000.
22. (Currently Amended) A vinyl polymer having an crosslinkable silyl group of the following general formula (6) at at least one terminus of its main chain:
$$-\text{CH}_2-\text{C}(\text{R}^1)(\text{R}^2)-\text{C}(\text{R}^6)(\text{R}^7)-\text{R}^8-\text{C}(\text{R}^9)-\text{CH}_2-\text{[Si}(\text{R}^{10})_{2-b}(\text{Y})_b\text{O}]_m-\text{Si}(\text{R}^{11})_{2-a}(\text{Y})_a$$

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wherein R¹ and R² are the same or different, each represents a hydrogen atom or a univalent organic group derived from the group bound to a vinyl group of a vinyl monomer used for the production of a main chain of the polymer; R⁶ and R⁷ are the same or different, each represents an electron-withdrawing group or one of them represents an electron-withdrawing group with the other representing hydrogen, an alkyl group having 1 to 10 carbon atoms, or phenyl; R⁸ represents a direct bond or a divalent organic group having 1 to 10 carbon atoms and optionally containing one or more ether bonds; R⁹ represents hydrogen, an alkyl group having 1 to 10 carbon atoms, an aryl group having 6 to 10 carbon atoms, or an aralkyl group having 7 to 10 carbon atoms; R¹⁰ and R¹¹ are the same or different, each represents an alkyl group having 1 to 20 carbon atoms, an aryl group having 6 to 20 carbon atoms, an aralkyl group having 7 to 20 carbon atoms, or a triorganosiloxy group of the formula (R')₃SiO- (R' represents a univalent hydrocarbon group of 1 to 20 carbon atoms and three R's are the same or different) and when two or more R¹⁰ or R¹¹ occur, they are the same or different; Y represents hydroxyl or a hydrolyzable group and when two or more Y occur, they are the same or different; a represents 0, 1, 2, or 3; b represents 0, 1, or 2; m represents an integer of 0 to 19, provided that a+mb \geq 1.

23. (Original) The polymer according to Claim 22 wherein the electron-withdrawing group represents one group selected from the group consisting of -CO₂R (in which R represents an alkyl group having 1 to 20 carbon atoms, an aryl group having 6 to 20 carbon atoms, or an aralkyl group having 7 to 20 carbon atoms), -C(O)R (R represents the same as described above), and -CN.

24. (Previously presented) The polymer according to Claim 22 wherein its main chain is prepared by polymerizing a (meth)acrylic acid type monomer.

25. (Original) The polymer according to Claim 24 wherein the (meth)acrylic acid type monomer is an acrylic ester monomer.

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26. (Original) The polymer according to Claim 24 wherein the (meth)acrylic acid type monomer is a methacrylic ester monomer.

27. (Original) The polymer according to Claim 25 wherein the acrylic ester monomer is butyl acrylate.

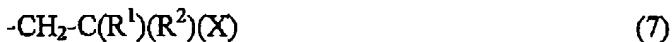
28. (Previously presented) The polymer according to Claim 22 wherein its main chain is prepared by polymerizing a styrene type monomer.

29. (Previously presented) The polymer according to Claim 22, wherein a ratio (Mw/Mn) of its weight average molecular weight (Mw) to number average molecular weight (Mn) as determined by gel permeation chromatography is not over 1.8.

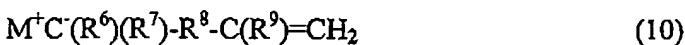
30. (Previously presented) The polymer according to Claim 22, wherein its number average molecular weight ranges from 500 to 100000.

31-37 (Canceled).

38. (Currently amended) A method for preparing the vinyl polymer having an alkenyl group at a terminus of its main chain according to Claim 13, which comprises polymerizing a vinyl monomer to obtain a vinyl polymer having a group of the following general formula (7) at at least one terminus of its main chain, and substituting an alkenyl-containing carbanion of the following general formula (10) for the terminal halogen of said polymer:



(wherein R¹ and R² are same or different, and each represents a hydrogen atom or a univalent organic group and X represents chlorine, bromine, or iodine);



(wherein R⁶ and R⁷ each represents an electron-withdrawing group or one of them represents an electron-withdrawing group with the other representing hydrogen, an alkyl group having 1 to 10 carbon atoms, or phenyl; R⁸ represents a direct bond or a divalent organic group having 1 to 10

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carbon atoms and optionally containing one or more ether bonds; R⁹ represents hydrogen, an alkyl group having 1 to 10 carbon atoms, an aryl group having 6 to 10 carbon atoms, or an aralkyl group having 7 to 10 carbon atoms; M⁺ represents an alkali metal ion or a quaternary ammonium ammonium ion).

39. (Original) The method according to Claim 38 wherein M⁺ represents sodium ion or potassium ion.

40. (Previously presented) The method according to Claim 38 wherein said vinyl monomer is polymerized using an organohalogen compound or a sulfonyl halide compound as an initiator and a transition metal complex as a catalyst.

41. (Original) The method according to Claim 40 wherein the transition metal complex is a complex of one metal selected from the group consisting of copper, nickel, ruthenium and iron.

42. (Original) The method according to Claim 41 wherein the transition metal complex is a complex of cooper.

43. (Previously presented) The method according to Claim 38 wherein said vinyl monomer is polymerized using a chain transfer agent.

44. (Currently amended) A method for preparing the vinyl polymer having a crosslinkable silyl group at a terminus of its main chain according to Claim 22, which comprises polymerizing a vinyl monomer to obtain a vinyl polymer having a group of the following general formula (7) at at least one terminus of its main chain, and substituting a crosslinkable silyl-containing carbanion of the following general formula (11) for a terminal halogen of said polymer;

-CH₂-C(R¹)(R²)(X)

(7)

(wherein R¹ and R² are the same or different, and each represents a hydrogen atom or a univalent organic group and X represents chlorine, bromine, or iodine);

M⁺C(R⁶)(R⁷)-R⁸-CH(R⁹)-CH₂-[Si(R¹⁰)_{2-b}(Y)_bO]_m-Si(R¹¹)_{3-a}(Y)_a

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{wherein R⁶ and R⁷ are the same or different, and each represents an electron-withdrawing group or one of them represents an electron-withdrawing group with the other representing hydrogen, an alkyl group having 1 to 10 carbon atoms, or phenyl; R⁸ represents a direct bond or a divalent organic group having 1 to 10 carbon atoms and optionally containing one or more ether bonds; R⁹ represents hydrogen, an alkyl group having 1 to 10 carbon atoms, an aryl group having 6 to 10 carbon atoms, or an aralkyl group having 7 to 10 carbon atoms; R¹⁰ and R¹¹ are the same or different, and each represents an alkyl group having 1 to 20 carbon atoms, an aryl group having 6 to 20 carbon atoms, an aralkyl group having 7 to 20 carbon atoms, or a triorganosiloxy group of the formula (R')₃SiO- (R' represents a univalent hydrocarbon group of 1 to 20 carbon atoms and three R's are the same or different) and when two or more R¹⁰ or R¹¹ occur, they are the same or different; Y represents hydroxyl or a hydrolyzable group and when two or more Y occur, they are the same or different; a represents 0, 1, 2, or 3; b represents 0, 1, or 2; m represents an integer of 0 to 19, provided that a+mb \geq 1; M⁺ represents an alkali metal ion or a quaternary ammonium ion}.

45. (Original) The method according to Claim 44 wherein M⁺ represents sodium ion or potassium ion.

46. (Previously presented) The method according to Claim 44 wherein said vinyl monomer is polymerized using an organohalogen compound or a sulfonyl halide compound as an initiator and a transition metal complex as a catalyst.

47. (Original) The method according to Claim 46 wherein the transition metal complex is a complex of one metal selected from the group consisting of copper, nickel, ruthenium and iron.

48. (Original) The method according to Claim 47 wherein the transition metal complex is a complex of copper.

49. (Previously presented) The method according to Claim 44 wherein said vinyl monomer is polymerized using a chain transfer agent.

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50. (Canceled)

51. (Currently amended) A curable composition comprising (a) the vinyl polymer having an alkenyl group of the following general formula (1) at a terminus of its main chain:

$-\text{CH}_2-\text{C}(\text{R}^1)(\text{R}^2)-\text{O}-\text{R}^3-\text{C}(\text{R}^4)=\text{CH}_2$ (1)

(wherein R¹ and R² are the same or different, and each represents a hydrogen atom or a univalent organic group derived from the group bound to a vinyl group of a vinyl monomer used for the production of a main chain of the polymer; R³ represents a divalent organic group having 1 to 20 carbon atoms and optionally containing one or more ether or ester bonds; R⁴ represents hydrogen, an alkyl group having 1 to 10 carbon atoms, an aryl group having 6 to 10 carbon atoms, or an aralkyl group having 7 to 10 carbon atoms), and (b) a hydrosilyl-containing compound.

52. (Original) A curable composition comprising, as a principal component, the vinyl polymer having a crosslinkable silyl group at a terminus of its main chain according to Claim 12.

53. (Previously presented) A curable composition comprising (a) the vinyl polymer having an alkenyl group at a terminus of its main chain according to Claim 13 and (b) a hydrosilyl-containing compound.

54. (Previously presented) A curable composition comprising, as a principal component, the vinyl polymer having a crosslinkable silyl group at a terminus of its main chain according to Claim 22.

55. (Currently Amended) A method for preparing the vinyl polymer having a crosslinkable silyl group at a terminus of its main chain according to claim 12 which comprises adding a hydrosilane compound having a crosslinkable silyl group of the following general formula (9):

$\text{H}-[\text{Si}(\text{R}^{10})_{2-\text{b}}(\text{Y})_{\text{b}}\text{O}]^{\text{m}}-\text{Si}(\text{R}^{11})_{3-\text{a}}(\text{Y})_{\text{a}}$ (9)

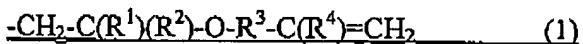
wherein R¹⁰ and R¹¹ are the same or different, each represents an alkyl group having 1 to 20 carbon atoms, an aryl group having 6 to 20 carbon atoms, an aralkyl group having 7 to 20

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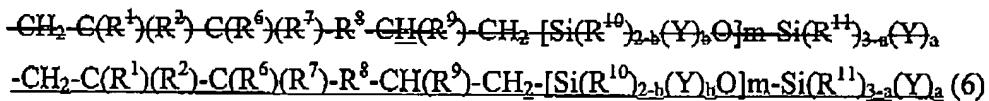
carbon atoms, or a triorganosiloxy group of the formula $(R')_3SiO-$, wherein R' represents a univalent hydrocarbon group of 1 to 20 carbon atoms and three R' 's are the same or different and when two or more R^{10} or R^{11} occur, they are the same or different; Y represents hydroxyl or a hydrolyzable group and when two or more Y occur, they are the same or different; a represents 0, 1, 2, or 3; b represents 0, 1, or 2; m represents an integer of 0 to 19, provided that $a+mb \geq 1$

to the a vinyl polymer having an alkenyl group of the following general formula (1) at at least one terminus of its main chain:



wherein R^1 and R^2 are the same or different, and each represents a hydrogen atom or a univalent organic group derived from the group bound to a vinyl group of a vinyl monomer used for the production of a main chain of the polymer; R^3 represents a divalent organic group having 1 to 20 carbon atoms and optionally containing one or more ether or ester bonds; R^4 represents hydrogen, an alkyl group having 1 to 10 carbon atoms, an aryl group having 6 to 10 carbon atoms, or an aralkyl group having 7 to 10 carbon atoms according to claim 13.

56. (Currently Amended) A method for preparing the vinyl polymer having a crosslinkable silyl group of the following formula (6) at at least a terminus of its main chain:

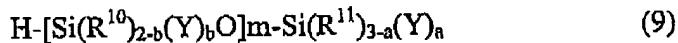


wherein R^1 and R^2 are the same or different, each represents a hydrogen atom or a univalent organic group derived from the group bound to a vinyl group of a vinyl monomer used for the production of a main chain of the polymer; R^6 and R^7 are the same or different, each represents an electron-withdrawing group or one of them represents an electron-withdrawing group with the other representing hydrogen, an alkyl group having 1 to 10 carbon atoms, or phenyl; R^8 represents a direct bond or a divalent organic group having 1 to 10 carbon atoms and optionally containing one or more ether bonds; R^9 represents hydrogen, an alkyl group having 1 to 10 carbon atoms, an aryl group having 6 to 10 carbon atoms, or an aralkyl group having 7 to 10 carbon atoms; R^{10} and R^{11} are the same or different, each represents an alkyl group having 1 to 20 carbon atoms, an aryl group having 6 to 20 carbon atoms, an aralkyl group having 7 to 20 carbon atoms, or a triorganosiloxy group of the formula $(R')_3SiO-R'$, wherein R' represents a

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univalent hydrocarbon group of 1 to 20 carbon atoms and the three R's are the same or different and when two or more R¹⁰ or R¹¹ occur, they are the same or different; Y represents hydroxyl or a hydrolyzable group and when two or more Y occur, they are the same or different; a represents 0, 1, 2, or 3; b represents 0, 1, or 2; m represents an integer of 0 to 19, provided that a+mb \geq 1; which comprises adding a hydrosilane compound having a crosslinkable silyl group of the following general formula (9):



wherein R¹⁰ and R¹¹ are the same or different, each represents an alkyl group having 1 to 20 carbon atoms, an aryl group having 6 to 20 atoms, an aralkyl group having 7 to 20 carbon atoms, or a triorganosiloxy group of the formula (R')₃SiO-, wherein R' represents a univalent hydrocarbon group of 1 to 20 carbon atoms and three R's are the same or different and when two or more R¹⁰ or R¹¹ occur, they are the same or different; Y represents hydroxyl or a hydrolyzable group and when two or more Y occur, they are the same or different; a represents 0, 1, 2, or 3; b represents 0, 1, or 2; m represents an integer of 0 to 19, provided that a+mb \geq 1

to the vinyl polymer having an alkenyl group at at least one terminus of its main chain according to claim 13.